

ABSTRACT

The illustrative embodiment is a simulation system for practicing vascular-access procedures without using human subjects. The simulator includes a data-processing system and a haptics interface device. The haptics device provides the physical interface at which an end effector (*e.g.*, medical instrument, such as a needle, catheter, *etc.*) is manipulated to simulate needle insertion, *etc.* In some embodiments, the orientation of the end effector is sensed. In some embodiments, the end effector is reversibly couples to a force-feedback system, but not until the user does so.